

# 5th International Conference on the use of Space Technology for Water Resources Management

ACCRA

Session 5c: Space Technology, Water Scarcity and Drought - Vegetation and Agriculture

## The role of GSSTI in Water Resources Management in Ghana



# Space and water resource management

- **Footprints of Artisanal mining along water bodies**
- **Evapotranspiration using EO data**
- **Drought Characterization for water resource management**
- **Crop monitoring**
- **Estimating water budgets using EO data / Capacity building of stakeholders**

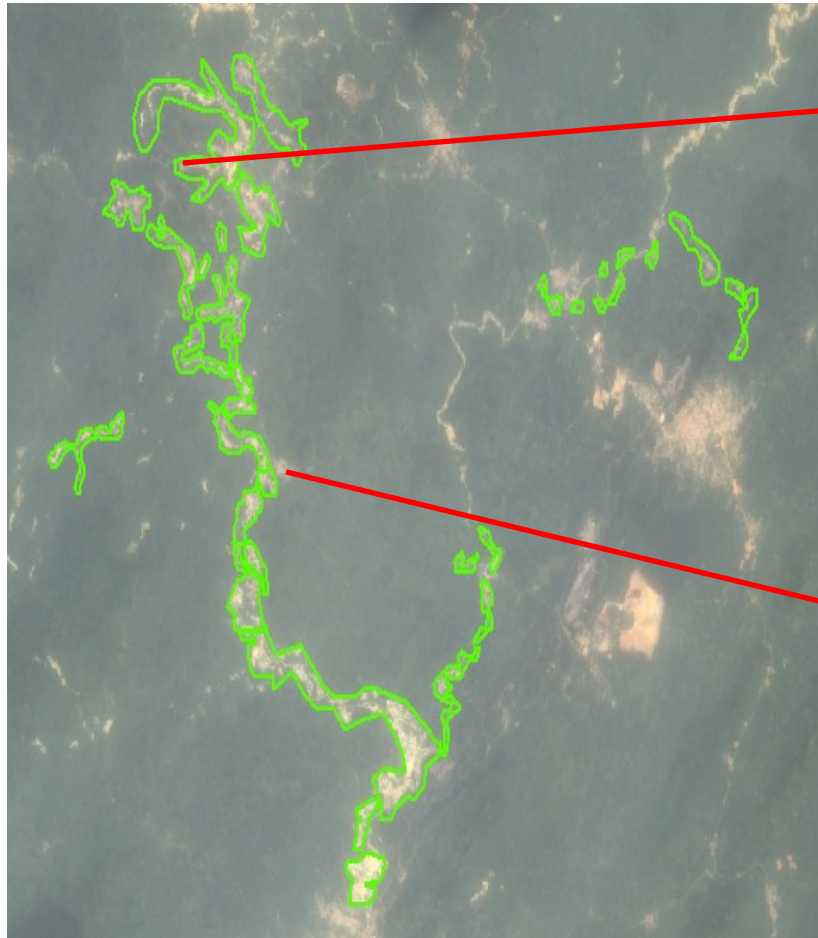
# Artisanal Mining

- The resulting map of gold mining also reveals patterns in mining location.
- Often, artisanal mines appear to be co-located with major rivers, particularly the Ofin and Ankobra Rivers.
- These mines leave a distinct footprint with a series of ponds following these major rivers.

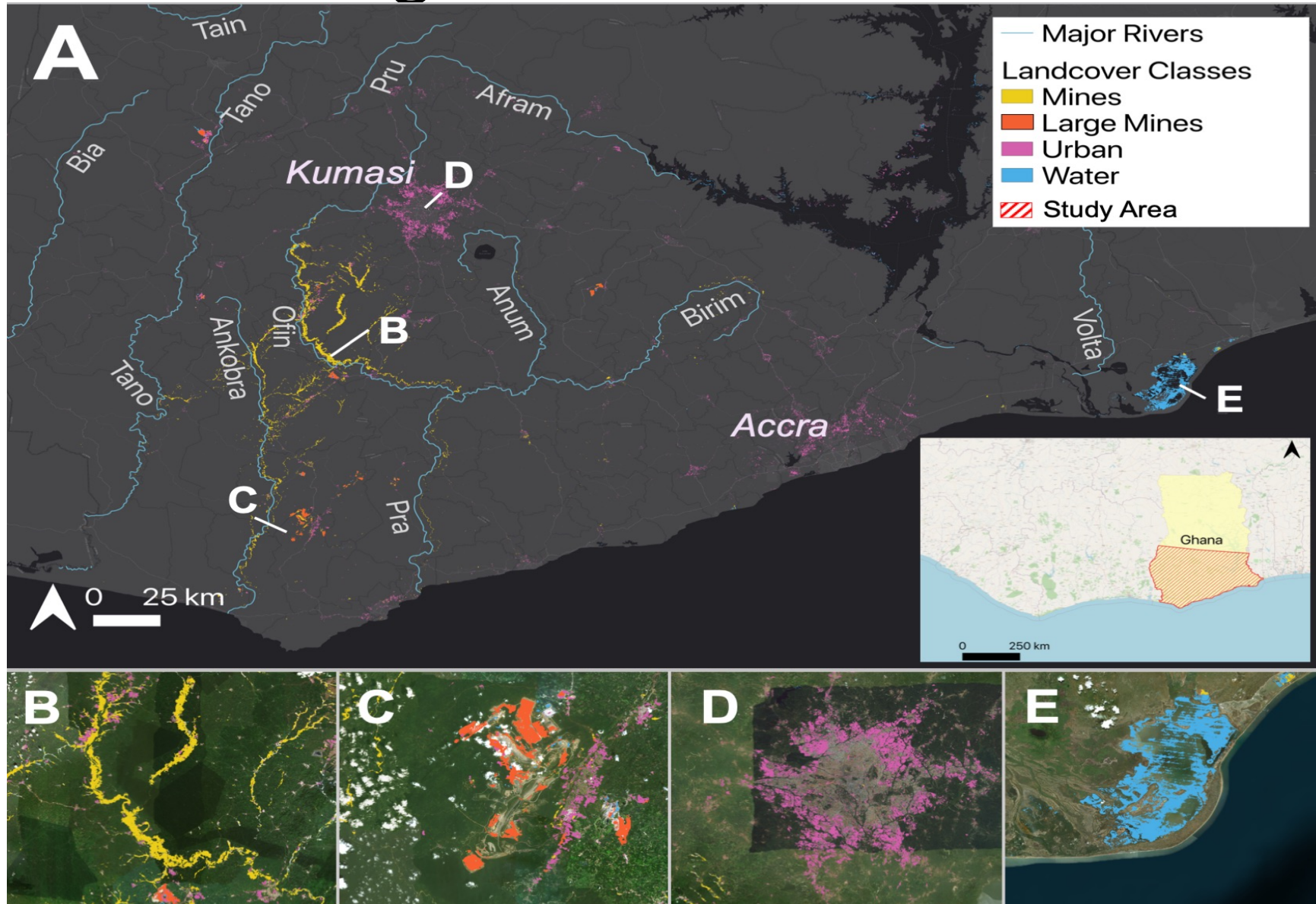
# Artisanal Mining

- The co-location of many mining operations with major waterways has significant implications for health and water quality in the region, as well as food security.
- In particular, the amalgamation process to remove gold from sediments can result in heavy metal contamination and have a direct impact on indicators of SDG 3 and human health.
- The co-location of mines with major rivers indicates negative impacts extending beyond deforestation and exposure to Hg, with notable impacts on indicators of SDG 6

# Artisanal mining - Quantifying Land area



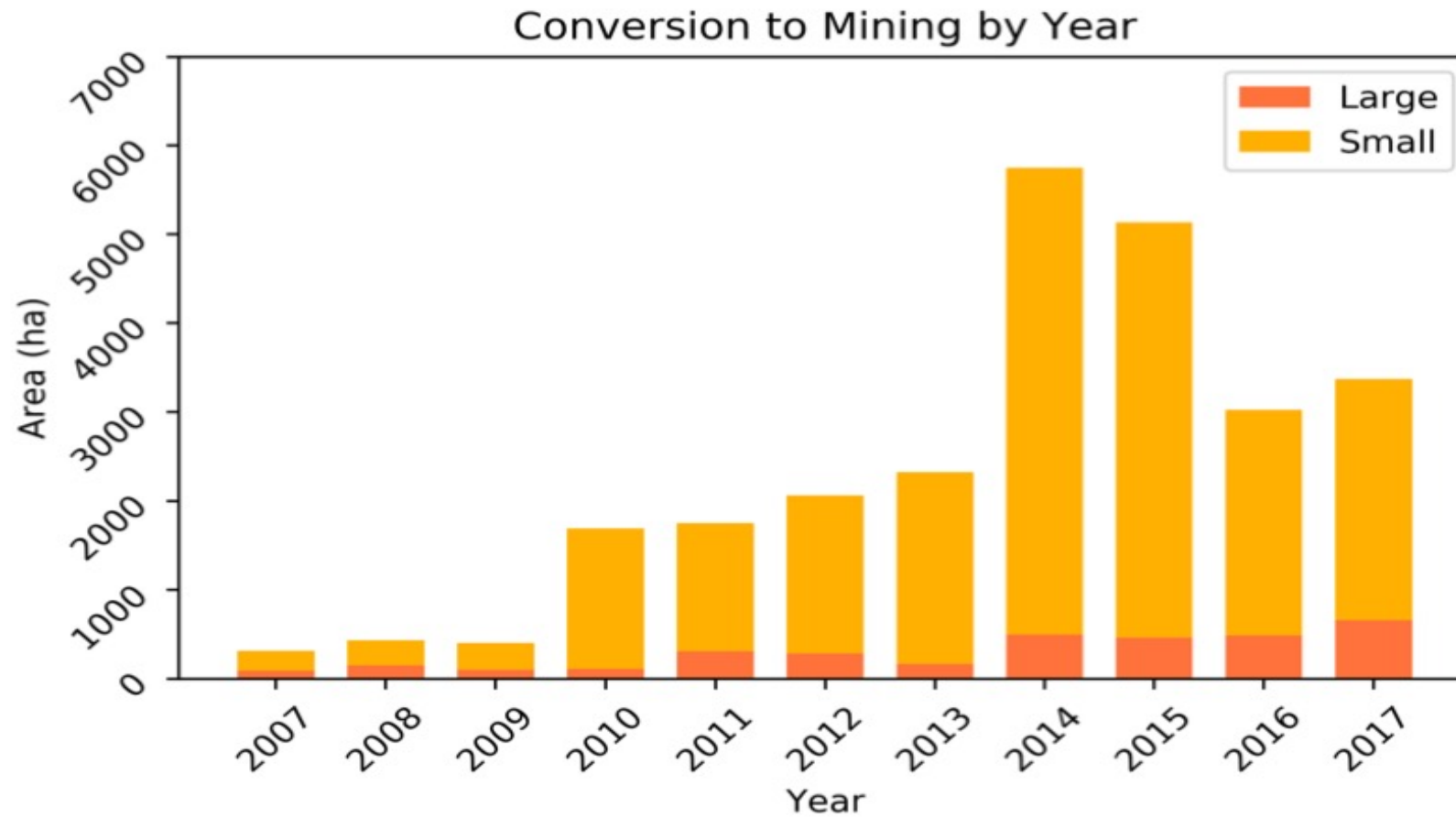
# Artisanal Mining - classification





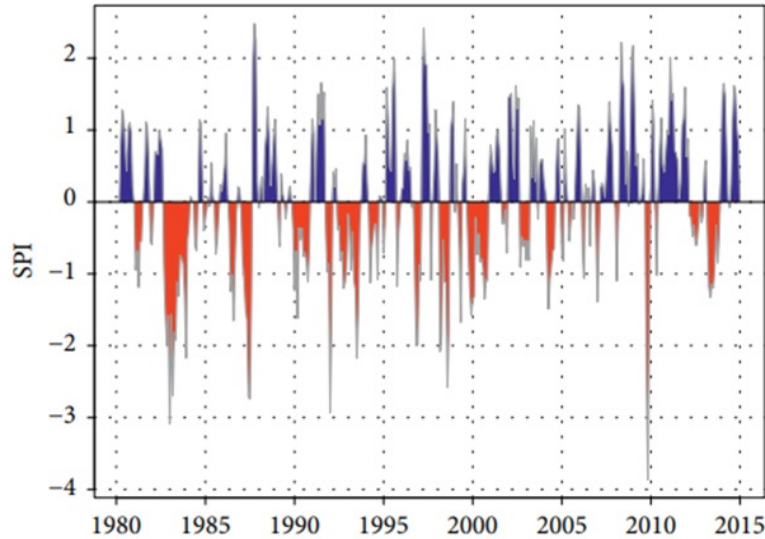
# Land conversion to Mining – 2007 - 2017

**B**



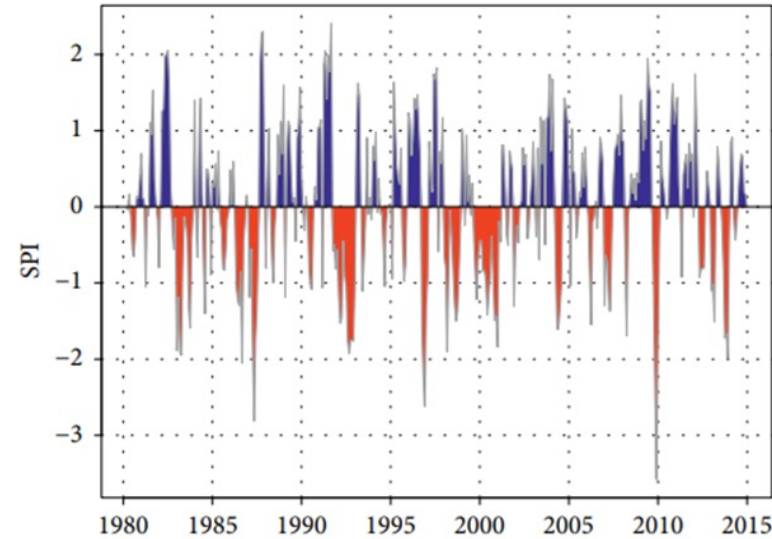
# Drought Characterization in Coastal Ghana

Accra, 3-month SPI



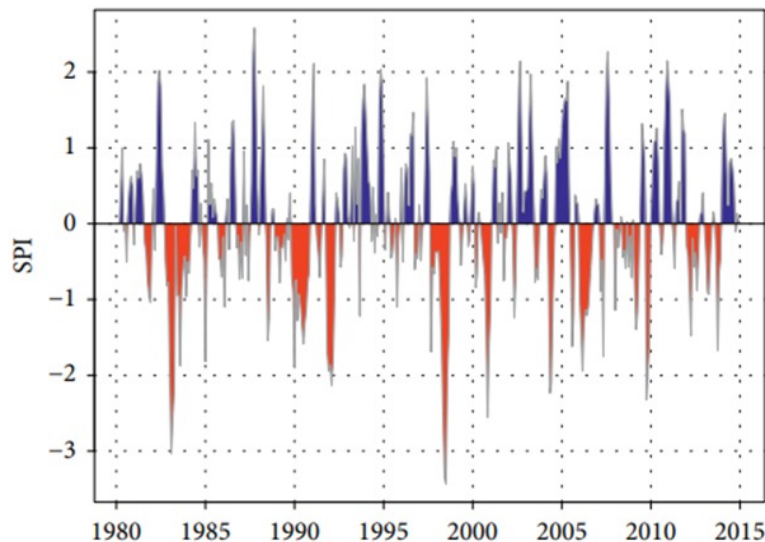
(a)

Ada, 3-month SPI

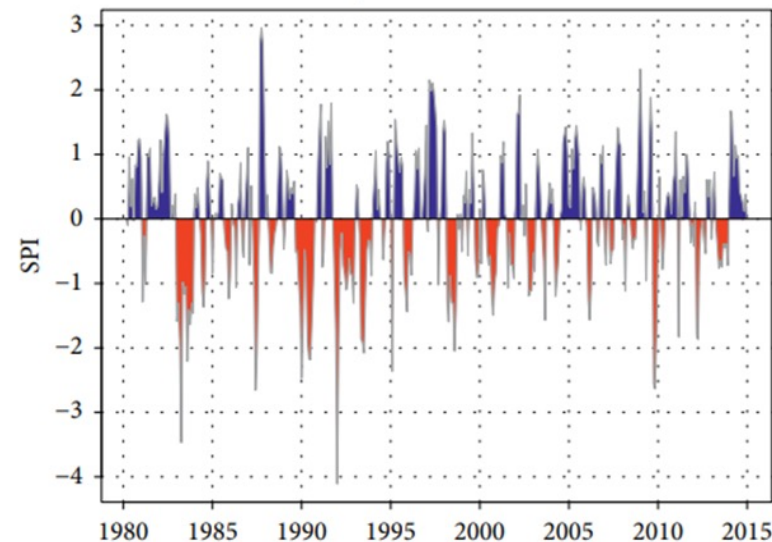


(b)

Axim, 3-month SPI

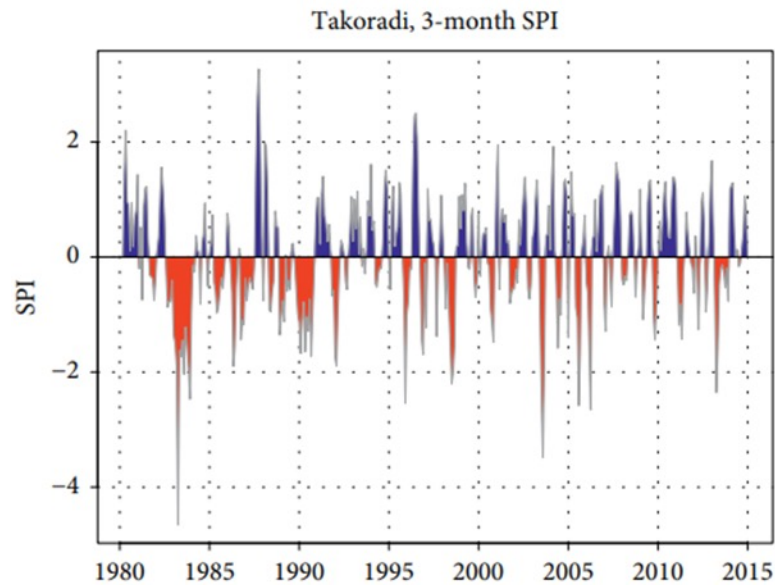


Saltpond, 3-month SPI

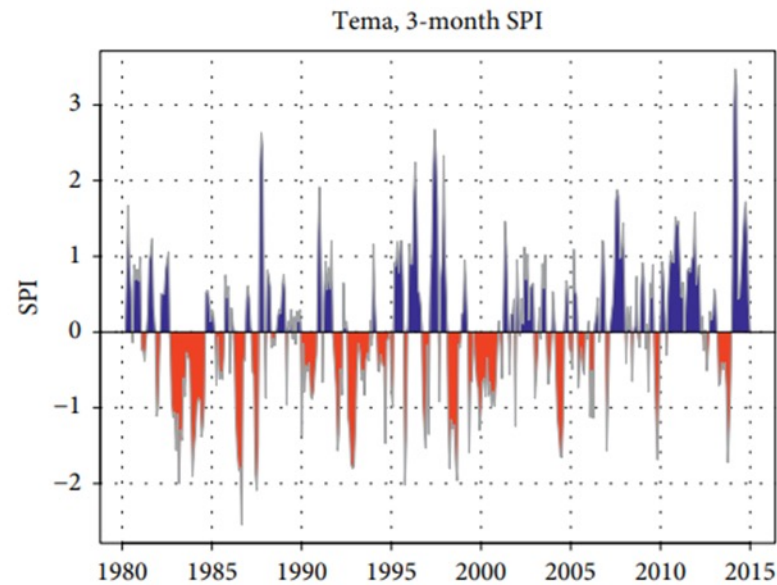


- Coastal Ghana experienced mild to severe drought over the years.
- Major historic drought periods observed are 1983 to 1984, 1988, 1993, 1997 to 1998, 2000 to 2001, 2009, and 2012–2013 for most coastal stations.





(e)



(f)

Accra, Tema, Ada, and Saltpond indicates, beyond 2005, these stations experienced very short drought periods and less drought extreme conditions and becoming wetter after 2005.

The West Coast (Axim and Takoradi) during the same period are experiencing moderate drought conditions in recent years.

Durations of drought over Coastal Ghana in recent times are short with weak intensities and some stations showing significant increase in the SPIs

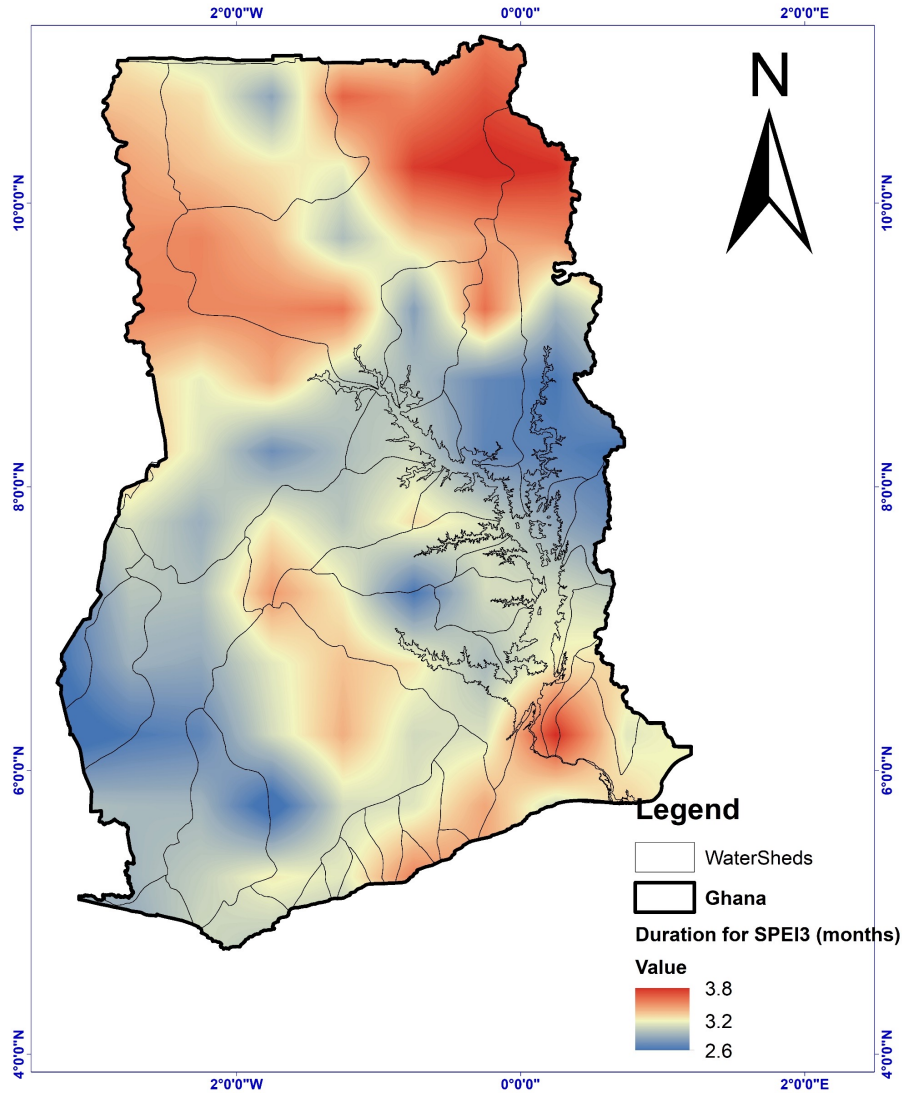
Drought conditions as shown in the SPI results exhibited interannual variations with moderate to severe drought conditions occurring nearly every half a decade for all

SPI further suggests, drought in recent years does not last long for most stations.

# Drought Characterization

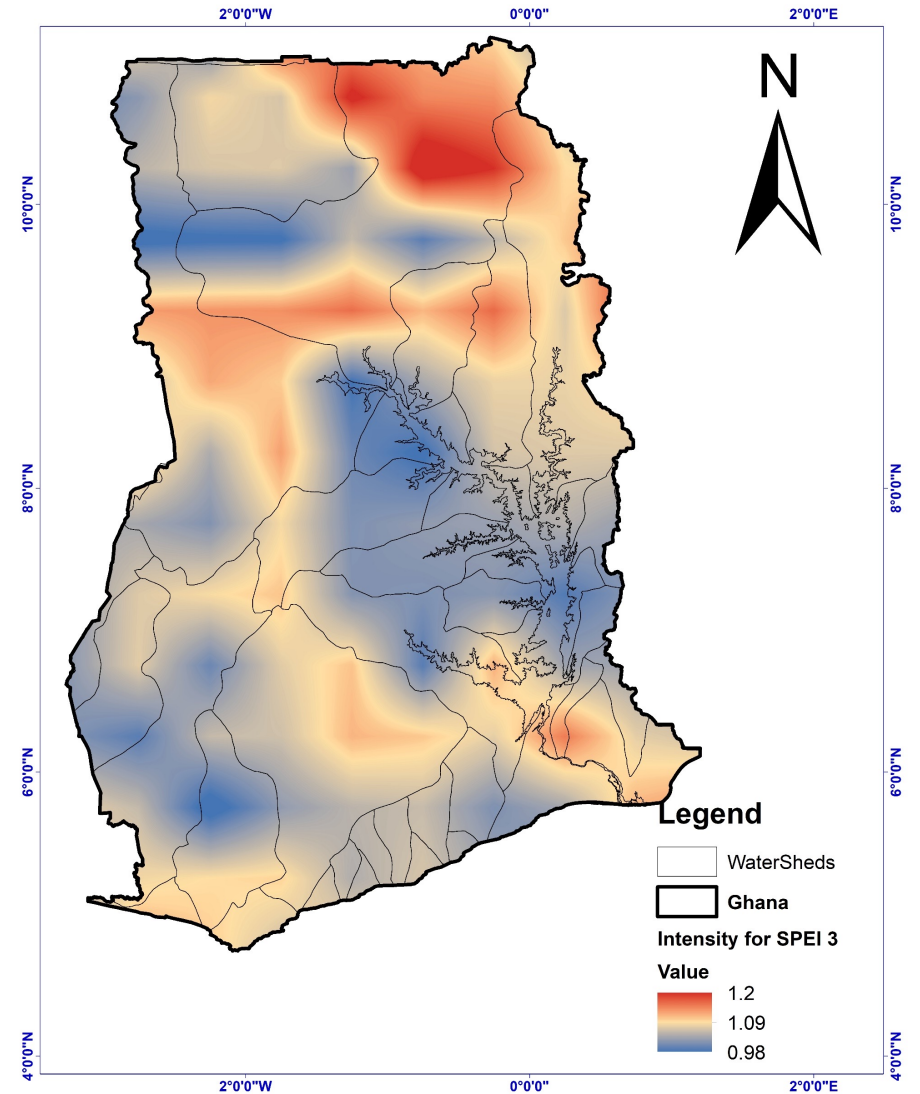
Data: SPEIbase  
v.2.6 [Dataset]

Period used:  
1981-2016



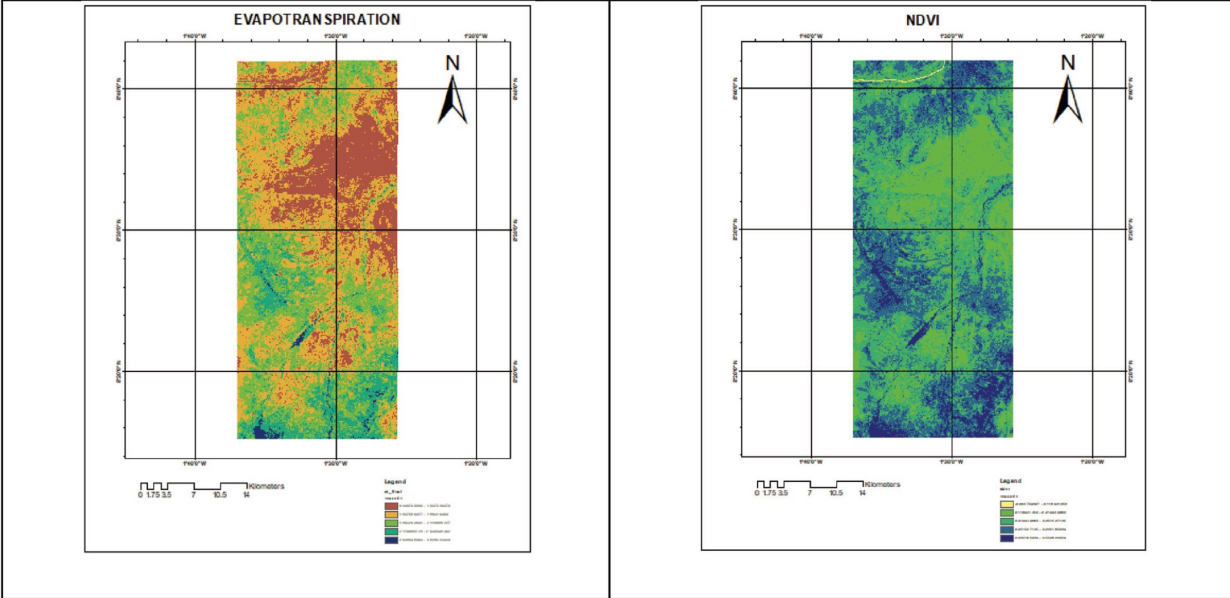
Drought is prominent in  
The north and  
Along the east coast

Drought is prominent  
in some water basins  
compared to others



# Mapping evapotranspiration

Spatial and temporal distribution of evapotranspiration in five land use classes with their corresponding normalized difference vegetation index



Spatiotemporal distribution of evapo- transpiration increases strongly with normalized difference vegetation index (NDVI) in different land uses

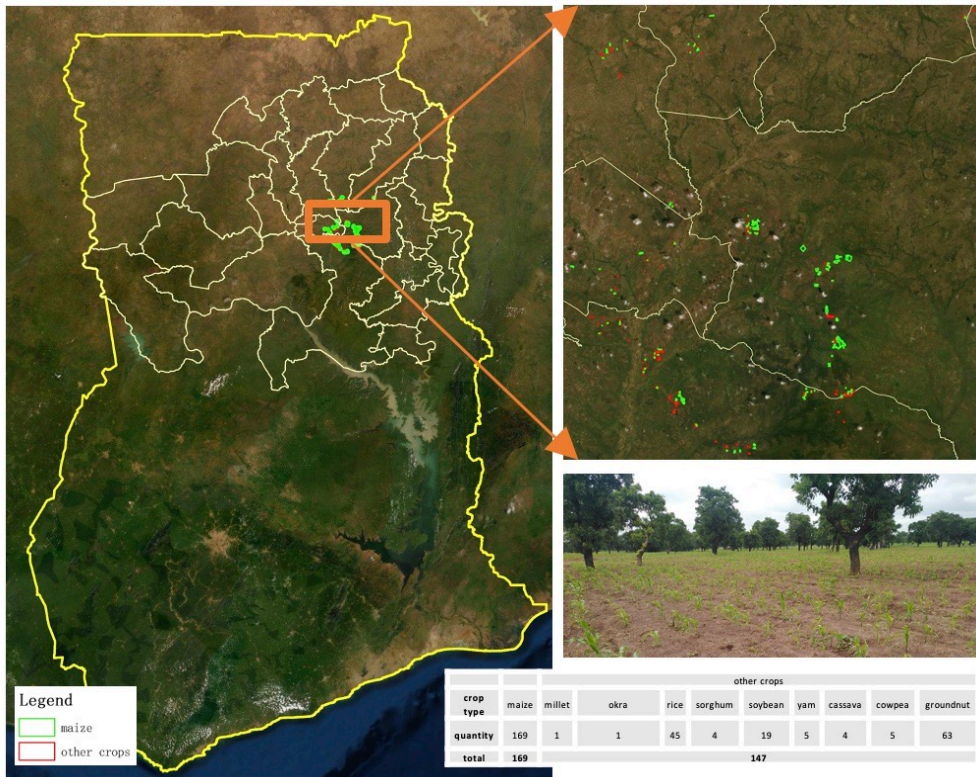
TABLE 1: ET and NDVI values in February.

Classname	ET	NDVI
Savanna	1.8819	0.2519
Farm	1.7050	0.2338
Settlement	1.7665	0.2390
Unclear	1.6426	0.2316
Water	0.9982	0.1183

TABLE 2: ET and NDVI values in November.

Classname	ET	NDVI
Savanna	2.9180	0.5660
Farm	2.7763	0.5498
Settlement	2.6090	0.5067
Unclear	2.4920	0.5010
Water	1.2295	0.1539





To understanding the determinants of agricultural productivity

Monitoring of Crop lands and identifying crop type

Crop yield measurement approaches

Crop cut

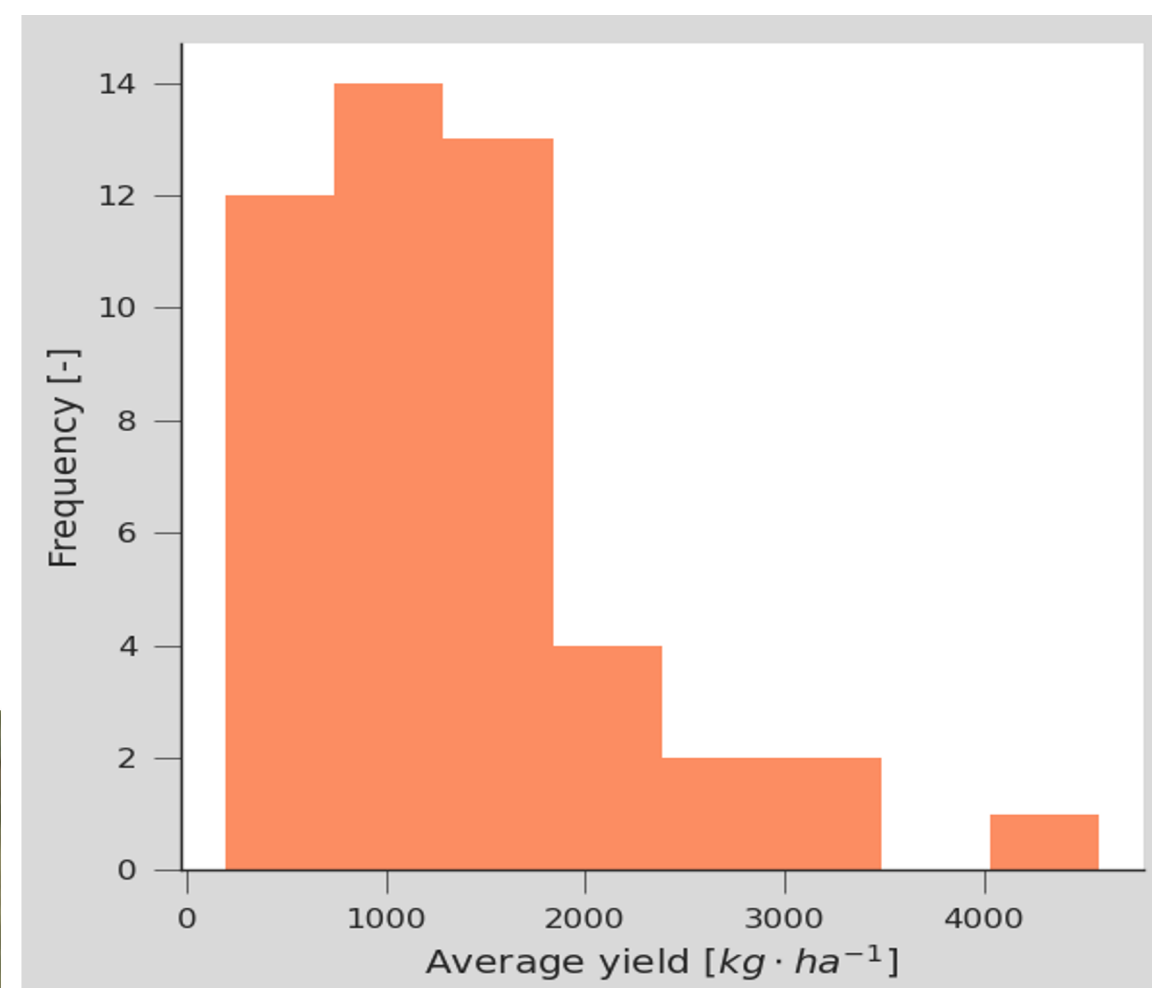
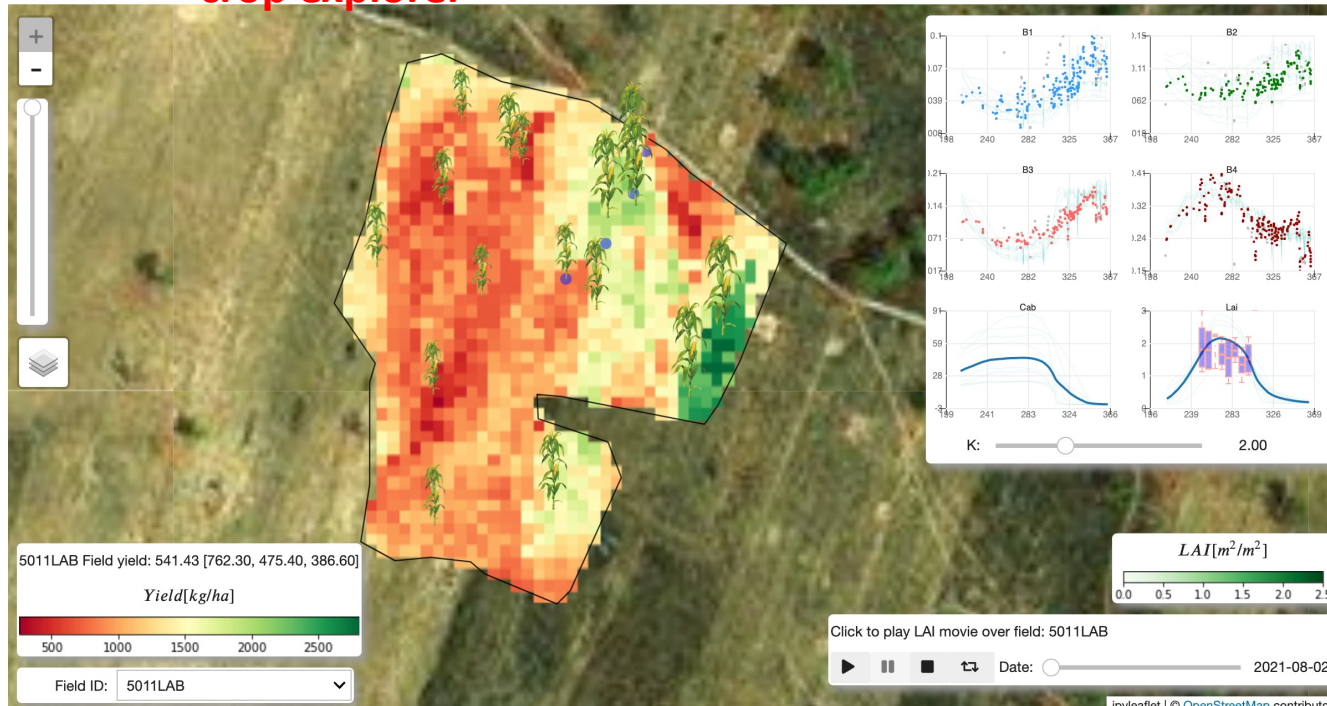
Harvest entire plot

# Implement crop explorer

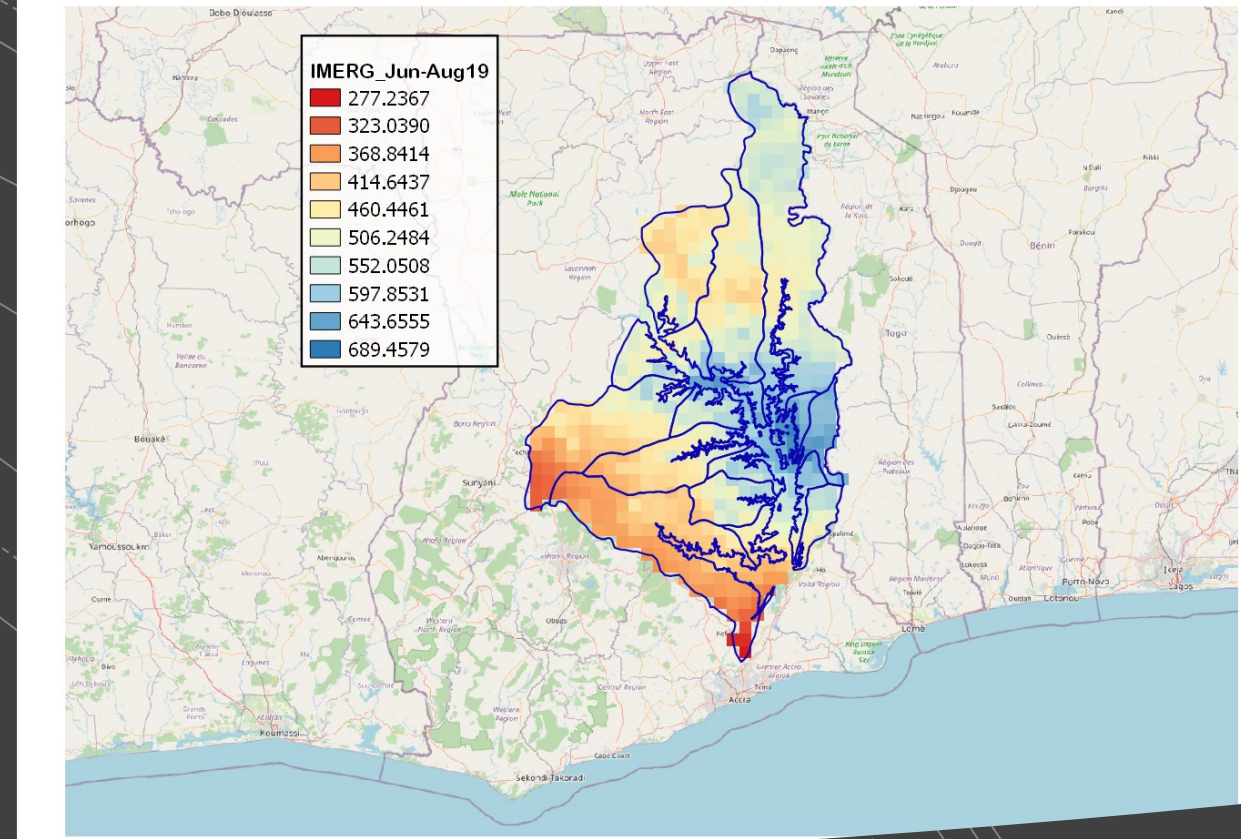
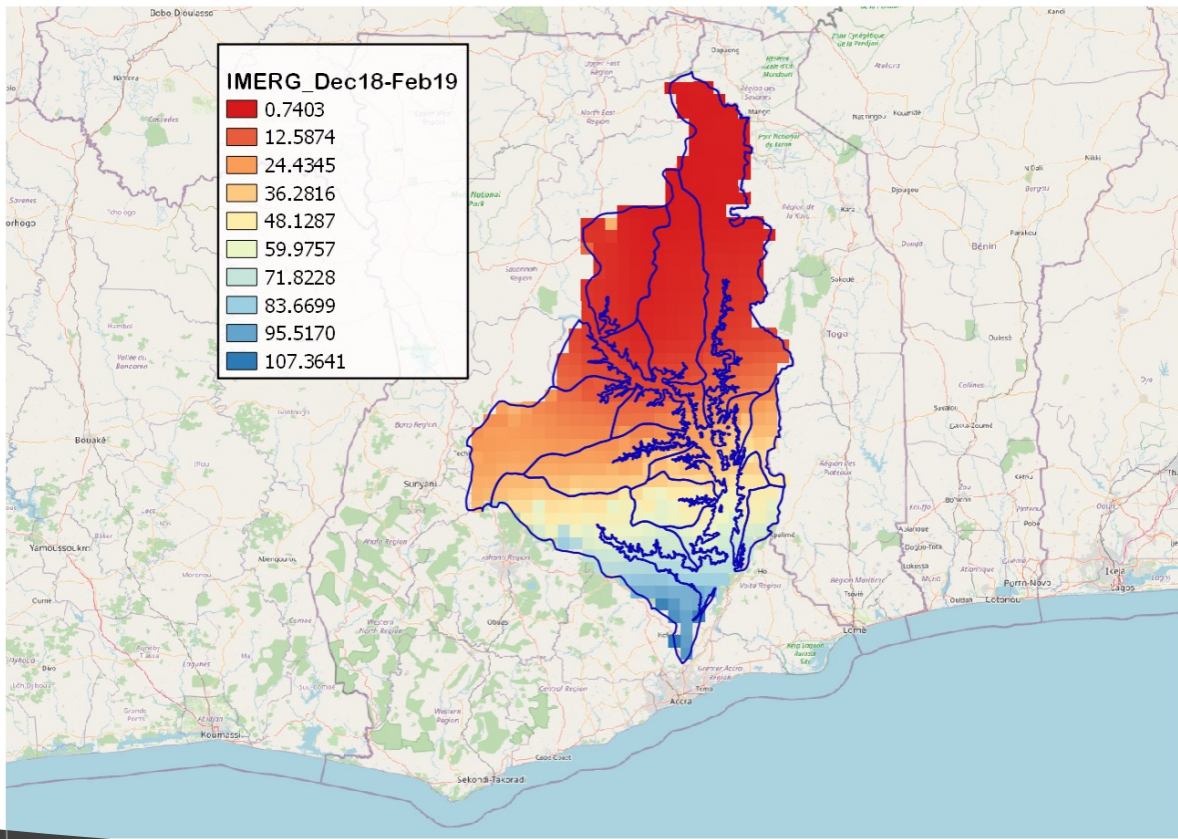
Ground data (& farmer experience) tell of local heterogeneity

- *But only coarse spatial resolution driving data from crop models*
  - Essentially same weather/drivers for all fields
- *Other variation expressed in model parameters*
  - Can achieve with EO and DA
- Only data for a **single year** here (2021) & **region**

## crop explorer







Assessing water budget in the Volta basin during the wet and dry season





Capacity building on monitoring SDG 6.1

Trained 50 stakeholders in 2021

- Build Earth Observation applications in monitoring SDGs in the area of water resources management